

CLAIMS

What is claimed is:

1. A bioabsorbable structure comprising a filament defining an inner lumen, the structure being adapted for use in tissue engineering.
2. A structure of claim 1 adapted for use in tissue engineering of hair follicles.
3. A bundled plurality of the structures of claim 1 the bundle being adapted for use in tissue engineering applications selected from the group consisting of bone, cartilage and osteochondral tissues.
4. A structure of claim 1 wherein the filament comprises an inner layer and an outer layer, the inner layer having an inner surface which defines the lumen.
5. A structure of claim 1 comprised of one or more bioabsorbable materials selected from the group consisting of: poly(lactic acid), poly(glycolic acid), poly(trimethylene carbonate), poly(dimethyltrimethylene carbonate), poly(amino acids)s, tyrosine-derived poly(carbonates)s, poly(carbonates)s, poly(carprolactone), poly(*para*-dioxanone), poly(esters)s, poly(ester-amides)s, poly(anhydrides)s, poly(ortho esters)s, collagen, gelatin, serum albumin, proteins, polysaccharides, mucopolysaccharides, carbohydrates, glycosaminoglycans, poly(ethylene glycols)s, poly(propylene glycols)s, and copolymers, blends, and mixtures of said bioabsorbable materials, as well as oligomers containing bioabsorbable linkages that are block-copolymerized with otherwise non-degradable polymers that are metabolizable or excretable upon release by hydrolysis or degradation of said bioabsorbable linkages.
6. A structure of claim 4 in which said outer layer is substantially non-porous and said inner layer porous.
7. A structure of claim 4 in which said inner layer is comprised of biomaterials selected from the group consisting of: collagen, gelatin, cellulose derivatives, starch, dextrin, chitosan, lipoproteins, chondroitin-6-sulfate, recombinant human forms of collagen and gelatin, fibrinogen, fibrin, fibronectin, laminin, albumin, serum proteins, polysaccharides, mucopolysaccharides, natural biopolymers that naturally occur in the

human body, and copolymers, blends and mixtures of said biomaterials and crosslinked derivatives thereof.

8. A structure of claim 4 in which said outer layer is comprised of a copolymer of lactide and glycolide and said inner layer is comprised of a bioabsorbable material selected from the group consisting of crosslinked hyaluronic acid and chondroitin-6-sulfate.

9. A process for the manufacture of the bioabsorbable structures of claim 4 comprising the steps of:

- a. preparing a molded structure comprising a first bioabsorbable material and a porogen;
- b. removing the porogen from the molded structure of step a; and
- c. cross-linking the bioabsorbable material;
- d. coating the structure with a second bioabsorbable material.

10. The process of claim 9 wherein the first bioabsorbable material comprises a mixture of chondroitin-6-sulfate and gelatin and the porogen comprises sebacic acid particles.

11. An implant for inducing the growth of a hair follicle comprising a structure of claim 2, the filament being seeded with cells selected from the group consisting of: cells obtained from hair follicle fragments, dermal papilla cells, dermal sheath cells, matrix cells, inner and outer root sheath cells; epidermis cells of adult or infant origin; dermis cells of adult or infant origin; stem cells derived from embryos, umbilical cord blood cells, bone marrow cells, adipose tissue cells, muscle cells, skin cells, and any combination of said cells.

12. An implant of claim 11 wherein said cells are multiplied in culture prior to being seeded on said filament.

13. An implant of claim 11 wherein said epidermal cells are seeded on the walls of the lumen of the filament and follicle cells are inserted into one end of said filament.

14. An implant of claim 13 wherein said follicle cells comprise dermal papilla cells.

15. An implant of claim 14 wherein said epidermal cells are seeded on the inner lumen of the filament and a clump of cultured dermal papilla cells is inserted into one end of the lumen of said filament.
16. A method of hair growth or restoration comprising of steps of:
 - a. obtaining scalp follicle cells;
 - b. culturing the follicle cells to increase their number;
 - c. providing a structure according to claim 2;
 - d. seeding the structure with epidermal cells;
 - e. seeding the epidermal cell-containing structure with the follicle cells obtained in step b; and
 - f. implanting the structure into skin where new hair growth is desired..
17. The method of claim 16 in which the cells of step d are obtained from human infant foreskin.
18. The method of claim 17 in which the cells of step d are supplemented with stem cells obtained from embryos, umbilical cord blood, bone marrow, adipose tissue, muscle, skin, and any combination of said cells.
19. The method of claim 17 in which the cells of step a are cultured from a follicle fragment selected from fragments comprising the dermal papilla, dermal sheath, matrix, and inner and outer root sheaths.
20. The method of claim 16 wherein the structure comprises chondroitin-6-sulfate.
21. A process for the manufacture of bioabsorbable structures comprising the steps of:
 - a. coating a fiber with particles;
 - b. coating the particle-coated fiber of step a with a solution of a bioabsorbable material;
 - c. rendering the bioabsorbable material insoluble in water; and
 - d. removing the fiber and particles.
22. The process of claim 21 further comprising the step of coating the resulting structure with a second bioabsorbable material.

23. The process of claim 21 wherein the fiber is nylon, the particles are sebacic acid, and the bioabsorbable material is hyaluronic acid.
24. The process of claim 22 wherein the fiber is nylon, the particles are sebacic acid, the bioabsorbable material is hyaluronic acid, and the second bioabsorbable material is a copolymer of lactide and glycolide.
25. A method for bone and cartilage growth comprising:
- obtaining bone or cartilage progenitor cells;
 - seeding the structure of claim 3 with cells of step a;
 - implanting the structure of step b into a site where the growth of new bone or cartilage tissue is desired.
26. The method of claim 25 wherein the structure comprises crosslinked hyaluronic acid.
27. A structure of claim 2 comprising bioabsorbable materials selected from poly(lactic acid), poly(glycolic acid), poly(dimethyltrimethylene carbonate), poly(trimethylene carbonate), poly(amino acids)s, tyrosine-derived poly(carbonates)s, poly(carbonates)s, poly(caprolactone), poly(para-dioxanone), poly(esters)s, poly(ester-amides)s, poly(anhydrides)s, poly(ortho esters)s, and copolymers, blends, and mixtures of said polymers as well as oligomers containing bioabsorbable linkages that are block-copolymerized with otherwise non-degradable polymers that are metabolized or excretable upon release by hydrolysis or degradation of said bioabsorbable linkages, and coated on its inside (luminal) surfaces with bioabsorbable materials selected from cellulose derivatives, starch, dextrin, chitosan, lipoproteins, recombinant human forms of collagen and gelatin, chondroitin-6-sulfate, fibrinogen, fibrin, fibronectin, laminin, albumin, other serum proteins, polysaccharides, mucopolysaccharides, and other biopolymers that naturally occur in the human body, either in native form or rendered insoluble by crosslinking with crosslinking reagents, proteins, carbohydrates, glycosaminoglycans, poly(ethylene glycols)s, poly(propylene glycols)s, poly(acrylate esters)s, poly(methacrylate esters)s, poly(vinyl alcohol), and copolymers, blends and mixtures of said polymers.

28. The structure of claim 27 wherein the material comprises a copolymer of lactide and glycolide.
29. The structure of claim 28 wherein the bioabsorbable structure is coated with a copolymer of ethyleneoxide and propylene oxide.
30. A process for the manufacture of the structures of claim 2 comprising the steps of:
- a. coating a tapered mandrel with a water-soluble polymer;
 - b. attaching a bioabsorbable material to a tip of the mandrel;
 - c. coating the mandrel and the bioabsorbable material with a film-forming bioabsorbable polymer;
 - d. removing the mandrel from the structure.
31. The process of claim 30 wherein the bioabsorbable material comprises a mass of fibers comprised of chondroitin-6-sulfate and cross-linked gelatin and the film-forming bioabsorbable polymer comprises a copolymer of lactide and glycolide.